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DEPARTMENT OF ATTORNEY GENERAL



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August 9, 1990

Jon F. DeWitt
Varnum, Riddering, Schmidt & Howlett
Suite 800
171 Monroe Avenue, N.W.
Grand Rapids, MI 49503

Re: Kelley et al v Allied Paper et al

Dear Mr. DeWitt:

Please find enclosed MDNR's comments on the documents relating to final design of the stream diversion which you submitted under cover letter dated May 15, 1990.

We request that Allied submit final design documents for the Portage Creek Diversion by September 4, 1990.

Sincerely,

A handwritten signature in cursive script, reading "Stephen F. Schuesler".

Stephen F. Schuesler
Assistant Attorney General
Environmental Protection Division
P.O. Box 30212
Lansing, MI 48909
(517) 373-7780

SFS/cbs
d9/dewitt

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

August 7, 1990

TO: Stephen F. Schuesler and Kathleen Cavanaugh
Assistant Attorneys General
Environmental Protection Bureau
Department of Attorney General
OC(cw) aw

FROM: William Creal and Chris Waggoner
Great Lakes and Environmental Assessment Section
Surface Water Quality Division

SUBJECT: HM Holdings/Allied Paper
Proposed Interim Remedial Action
Involving Diversion of Portage Creek

We have reviewed HM Holdings/Allied Papers (Allied) Diversion Design Responses to MDNR Memo of 3/15/90 submitted May 15, 1990. This submittal was reviewed by Departmental staff of the Surface Water Quality, Waste Management and Environmental Response Divisions and staff of GZA/Donohue, our outside consultants on this matter. This memorandum addresses the technical issues which still have not been adequately addressed by Allied and follows the same numbering system used in the recent correspondences. Comments on the Tab sections of Allied's May 15, 1990 submittal have been incorporated into the appropriate enumerated technical issues.

We have completed this review pursuant to Judge Bell's June 5, 1990 order that the State and Allied continue negotiations on the proposed diversion of Portage Creek as an interim remedial action. We are concerned that negotiations on the proposed diversion will continue to delay remedial actions. It has already been a year and a half since Allied first proposed this action. The State has in good faith commented to the extent possible on the limited design information Allied has provided throughout this process. We recommend that Allied be required to submit final (100%) design documents by August 20, 1990. The final design document must address the concerns we have identified repeatedly over the past year.

We are willing to meet with Allied's technical staff to discuss our concerns and expedite the review process.

Technical Issues

Geotextile

1. The proposed design for rip/rap placement appears to be adequate to prevent the geotextile from being pulled away during construction of



the west bank of the diversion channel. However, the referenced drawing (G-11) does not clearly show this design. A modified drawing must be submitted.

Steel Sheet Piling

2. The requested cross section details must be provided indicating the distance the sheet piling will be extended into the existing embankment, the depth it will extend to and the soil boring data which supports the chosen depth.
3. Any soils removed during regrading operations must be sampled and disposed of pursuant to State and Federal Regulations (See #22). Areas regraded on the eastern side of the diversion channel must be revegetated to minimize erosion.
5. The size of the rip/rap must be provided.
6. In the area from 29+00 to 26+00, water may become trapped on top of contaminated soils remaining to the west of the west bank of sheet piling. All of the contaminated soils in this area must be removed, sampled and disposed of pursuant to State and Federal Regulations (See #22). The area must then be backfilled and graded to provide overland drainage into the diversion channel.
7. The sheet piling should be driven into native soils deep enough so that it will be adequately supported if mill pond sediments are excavated in the future. If Allied feels such a design is not feasible, they must provide a detailed explanation to support their conclusion. Temporary bracing during future removal actions may be adequate. However, any bracing must be temporary and not permanent in nature.

Alcott Street Dam Modification

8. The performance standard for construction methods and sequencing for the dam modification must be no erosion of exposed sediments in the present channel and no backup of water into completed construction areas, not a minimization of these events.

Construction Sequencing

9. Once the temporary sheet piling is placed across Portage Creek, and before the soil "plug" is pulled from the end of the west bank, the Creek is dammed and water not allowed to pass. We have two concerns with this proposal. First, the pressure of the Creek may blow the soil "plug" into the new channel. And secondly, if it doesn't blow out, when you remove it, it is likely that substantial amounts of the contaminated soil will be washed into the diversion channel. We recommend that diversion be done by coffering and bypass pumping while the "plug" is being pulled. reunite

Channel Elevation

11. Allied indicates that the diversion channel will match-up in elevation ± 1.5 feet where it intersects the existing stream channel. There is no reason that the diversion channel cannot be designed to match the exact elevation of the intersection with the existing stream channel and it must be designed to do so.

Channel Hydraulics

12. The HEC-2 model run must be submitted including docks and output.

Groundwater Contamination

13. It is doubtful that dewatering effluent containing detectable PCB concentrations will be allowed to be discharged untreated to either the City of Kalamazoo sanitary sewer or Portage Creek. Such a discharge is not expected to meet Michigan Water Quality Standards.
14. We remain very concerned that the proposed diversion may interfere with current groundwater remediation efforts by Strebor, Inc. In addition, Strebor is conducting investigations to further define the characteristics of the contaminated groundwater plume in areas expected to be in the path of the channel. An excerpt of Strebor's work plan for these investigations is attached.

Allied must provide a written review of the expected impact of the proposed diversion on Strebor's groundwater remediation and investigations. In addition, Allied must obtain written comments from Strebor containing their assessment as to the impact of the proposed diversion. The Allied and Strebor reviews can be combined in some manner, but must at a minimum clearly indicate the following: 1) An investigation of the impacts has been conducted; 2) Provide the results of the investigation; and 3) Strebor has conducted their own investigation of the impact or commented on the results of Allied's investigation.

15. The final design must provide details including the dimensions of the over excavation and the type of clean material to be used for backfill.
16. We are concerned that the proposed diversion channel will be located adjacent to potentially contaminated soils in the vicinity of the Performance Paper's storage tanks. The soil/sediment sampling plan (see #21) must include samples adjacent to the proposed diversion channel to assess the potential of these soils to contribute contaminated surface water run-off into the proposed diversion channel.

Dewatering

19. The site dewatering plan must contain a performance criteria requiring that there be no interference with Strebor's groundwater remediation and investigations.

Contaminated Sediments

22. There are two parts to the disposal plan in Tab 1, a sampling plan and disposal options. From the general description of the sampling plan, design appears to be adequate. However, the detailed information listed below must be provided before the plan can be approved.

- * The volume of material to be removed.
- * The number and location of the zones the diversion channel is to be divided into for sampling purposes.
- * The number and location of sampling stations.
- * The constituents to be sampled, analytical methods to be used and detection limits.

The Toxicity Characteristic Leaching Procedure (TCLP) must be used to characterize the sediments. The detection limits to be obtained for extractable metals using the TCLP are listed below:

<u>Constituent</u>	<u>Detection Level (mg/l)</u>
Arsenic	0.005
Barium	0.2
Cadmium	0.002
Chromium	0.01
Copper	0.2
Lead	0.001
Mercury	0.0004
Selenium	0.002
Silver	0.01
Zinc	0.3

To verify that contaminated sediments are not left in place, samples from below the identified removal area must be analyzed for each zone. The sampling plan must be approved prior to initiation of sampling.

The disposal plan identifies four options. The identified contaminant levels for disposal in a hazardous waste disposal facility and a PCB (TSCA) disposal facility are correct. However, the levels identified for disposal at a Type II landfill and on-site will be determined by the Department's Waste Management Division based on the results of the sampling conducted pursuant to the approved sampling plan. The following information must be submitted for a determination of appropriate disposal to be made.

- * The results of the sampling conducted pursuant to the approved sampling plan including quality control and quality assurance data.
- * Estimates of the volume of material to be removed for off-site disposal and the name and location of the proposed disposal facilities.
- * Estimates of the volume of material proposed for on-site disposal. For each proposed on-site disposal area, the following information must be provided; a detailed site map indicating proposed disposal areas, location of surface waters, wetlands, floodplains, and distance to groundwater, a legal description of property, and proposal for disposal site management.

Sediment Losses During Construction

23. The construction of the inlet and outlet of the diversion channel are the most critical in relation to the release of PCB contaminated sediments into Portage Creek and exacerbation of the existing PCB contamination problem. Therefore, the performance requirements related to sediment losses during construction must apply during the entire construction period specially in these critical areas.

The upstream and downstream sample locations should be Cork Street and Alcott Street, respectively. At each location, TSS samples must be taken 3 times daily as grab samples and PCBs once daily as a composite during construction. The TSS samples must be analyzed individually the same day. If the average TSS measurement downstream exceeds 5 times the Cork Street result or an agreed upon alternate upper control level, construction activities must cease until corrective measures are taken and Departmental approval obtained to resume construction.

Visual observations must also be made of stream color and turbidity, at the time of TSS sampling. If the visual observations find excessive and/or unusual color or turbidity, construction activities must cease until corrective measures are taken and Departmental approval obtained to resume construction.

Storm Sewer and Outfall Relocations

24. More information is needed on the 24" storm sewer and east bank interceptor placement. Drawing G-11 submitted with the 30% Concept Plans shows cross sections for a 36" storm sewer. Should this be 24"?
25. The HEC-2 model run results must be submitted including docks and output.

26. "Standard engineering practice" for storm sewer connections does not take into consideration contamination to the extent encountered at this site. A water tight connection to prevent leaking from inside the proposed diversion channel is required for the life of the channel.

Present Stream Channel

- 27/28. It appears the proposal is to allow water to collect and pond in the current stream channel with no discharge. As Allied has indicated, the water which collects in the current stream channel must be addressed in the final remedial action.

Public Access Restrictions

29. The fence requested by the Department and EPA that Allied has agreed to install should adequately restrict areas and protect the public from the construction hazards and PCB contamination on-site until final remediation.

Post Completion Monitoring and Maintenance

31. At a minimum, inspection and maintenance must occur monthly after high flow events. A report of each inspection and any maintenance activities must be filed with the Department.

Air Monitoring During Construction

33. The air emissions monitoring program must be submitted with the final design.

Property Ownership, Permits

35. The drawing identifying buildings and structures to be demolished must be submitted with the final design.
36. The final design must include an implementation schedule. The schedule should indicate the timing for obtaining necessary permits, property access, approval for relocating Performance Paper's utilities and obtaining easements.

Other Comments

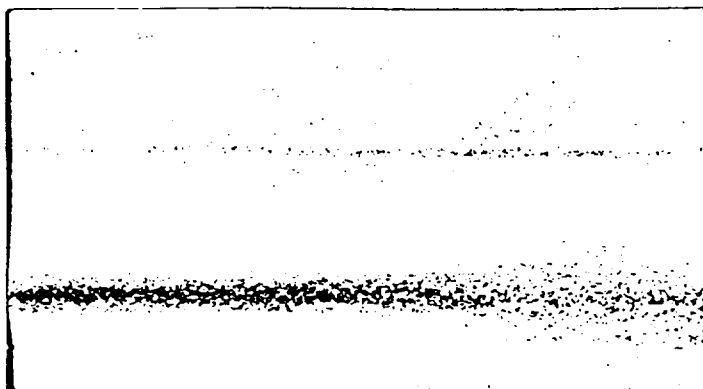
38. Tab 11 indicates that the steel sheet piling is expected to last 30 years and be the limiting factor in the design life of the diversion channel. In order to adequately determine the expected life of the steel sheet piling, the material at the site must be characterized for corrosivity. The final design must include the results of such characterization to support the 30 year design life claim.

41. Land and Water Management Division is going to conduct a site assessment to determine if there is a potential for wetland impacts related to the proposed diversion. The results of the site assessment will be forwarded to you. If the site assessment indicates the proposed diversion will impact wetlands, mitigation/restoration may be required.

Attachment

cc: S. Peelan/M. Ducharme, ERD
F. Morley/J. Banjtes, SWQD
S. Luzkow/S. Cornelius, ERD
D. Hall, LWMD
B. Venman/D. Roskoskey, WMD

BAY WEST, INC.




Remedial Investigation/Feasibility
Study Work Plan
for Strebor, Inc.

Submitted to:

Honigman Miller Schwartz and Cohn

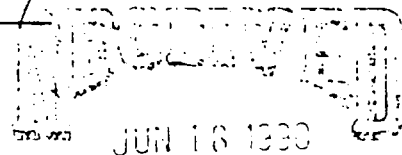
Submitted by:

Bay West, Inc.


Martin Wangenstein
Project Manager

June 15, 1990

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Human exposure to site contaminants is plausible via dermal contact with impacted surface waters (primarily Portage Creek), ingestion by consumption of game fish that have bioconcentrated certain contaminants, and ingestion of contaminated ground water. At this time there is no evidence of drinking water wells completed in the contaminated zone and the contamination does not likely extend to potable ground water supplies.

Short term exposure (primarily via inhalation) to human receptors adjacent to the site may occur with certain of the remediation alternatives, such as excavation, where exposed contaminants could be entrained into the air.

4.0 WORK PLAN RATIONALE

4.1 General

The Remedial Investigation is the primary vehicle for discovery and identification of site-related contamination. Since previous investigations have already identified the general contaminants and subsurface conditions beneath and adjacent to the site, data collected during those investigations will be the basis for the investigative work outlined in this plan.

Data collected during the Remedial Investigation will be utilized to complete the Baseline Risk Assessment and Remedial Alternatives (Feasibility) Study. The Baseline Risk Assessment will provide an evaluation of the potential threat to human health and the environment in the absence of any remedial action. In addition, the risk assessment will provide the basis for determining whether or not additional remedial action or source control measures are necessary and the justification for performing such actions.

The Feasibility Study will develop and examine appropriate options that will minimize the exposure of human health and the environment to Strebor-based contaminants. The Feasibility Study will occur in three phases: the development of alternatives, the screening of the alternatives, and the detailed analysis of alternatives. Typically, the alternatives are developed concurrently with the Remedial Investigation, with the results of one influencing the other in an iterative fashion.

Based on data collected to date, the primary areas which warrant additional investigation are the following:

- o former historical uses of the Strebor and adjacent properties,
- o identifying and characterizing Strebor-based contaminants,
- o defining the subsurface stratigraphy and its role in ground water and contaminant transport,
- o characterizing the hydrogeologic setting beneath the site and its role in contaminant transport,
- o defining the distribution of contaminants in the unconfined and confined aquifers,
- o determining contaminant fate and transport within the soil and ground water, and
- o determining the distribution, fate, and transport of contaminated surface sediments.

Specific data requirements for each of the above described areas are contained in the following discussion. Details regarding the individual tasks of the Work Plan are discussed in the **Remedial Investigation Tasks** and the **Feasibility Study Tasks** sections of this plan.

4.2 Site History and Regional Information

Currently, insufficient data exist as to the past uses and production activities of the Strebor and adjacent properties (Redker-Young Holdings Ltd., and Allied Corporation) to confirm all known or suspected sources of contamination. Pertinent information on the operational history of the three properties will be reviewed, and interviews with former Strebor plant employees will be performed to augment historical data collected to date. These data will be utilized to determine if work in addition to that completed to date or detailed in this work plan, needs to be completed. In addition, site-specific and regional information will also be compiled to help identify subsurface migration pathways, and potential human and environmental receptors.

4.3 Subsurface Stratigraphy

The subsurface stratigraphy beneath the Strebor facility controls or affects the movement of ground water, and the movement and transformation of contaminants. Previously collected data indicate that the site is underlain by a complex mixture of gravel, sand, silt, and clay deposits of varying thickness. Specifically, the site appears to be underlain by a series of water bearing sand and gravel units and relatively impermeable silt- and clay-rich units.

Due to the complex depositional environment of the unconsolidated sediments, and the importance of understanding the subsurface stratigraphy and its influence on the movement of contaminants, additional stratigraphic investigation is warranted. The completion of a geophysical survey beneath and adjacent to the site will be the primary investigative technique utilized to further define the stratigraphy of the unconsolidated sediments.

The geophysical survey is being employed as the primary method of investigation due to its ease of completion, data quality and reliability, and cost effectiveness. Data collected from the geophysical survey will be used in conjunction with previously completed soil borings to determine the final completion depths and locations of the additional ground water monitor wells.

4.4 Hydrogeology

Site specific hydrogeologic information is necessary to define the thicknesses and locations of aquifers and aquitards, ground water flow directions, and ground water or surface water interactions. An understanding of the above information is paramount for identifying the transport and ultimate fate of contaminants.

The current network of monitor wells have defined the general flow characteristics of the unconfined aquifer. However, additional information is needed to assess the surficial aquifer's hydraulic characteristics further downgradient of the site, as well as the hydraulic characteristics of the underlying confined and/or semi-confined aquifers.

To further investigate the hydraulic characteristics of the surficial unconfined and confined aquifers, additional ground water monitor wells will be installed and monitored. Water level measurements and hydraulic testing will be performed on the newly

installed monitor wells to confirm previously collected vertical and horizontal ground water gradient data.

4.5 Contaminant Identification and Characterization

Identification and characterization of the wood treating solution(s) formerly mixed and packaged at the site has been examined during previous investigations. However, further investigation is warranted to identify and characterize materials deposited in the former lagoon. This information will be collected by: 1) interviewing former plant personnel familiar with the operation of the lagoon; 2) reviewing existing documents pertaining to the operation of the lagoon; and, 3) completing physical and chemical analyses on ground water, soil, and fill material in the vicinity of the former lagoon.

4.6 Distribution of Subsurface Contamination

Previously collected ground water quality data have delineated the approximate horizontal distribution of LWI product and dissolved ground water contamination emanating from the site. However, additional investigation needs to be completed to: 1) determine if LWI product and/or dissolved contamination is preferentially migrating along sewer and railway backfill material immediately east of the site; 2) define the extent of contamination to the underlying semi-confined/confined aquifers; and, 3) further define the approximate location of the leading edge of soluble contamination.

The above stated data needs will be met by conducting a soil vapor survey within and adjacent to the sewer and railway fill material, and completing and sampling a select number of monitor wells installed within the surficial unconfined and semi-confined/confined aquifers.

The soil vapor survey is the preferred technique for screening the backfill material and near-surface soil for LWI product and associated contaminants due to the following:

- o shallow depth to ground water (and hence LWI product, if present),
- o good liquid phase-vapor phase partitioning characteristics of the LWI product,

- o minimal above ground space requirements and time needed to complete a vapor monitoring point (important due to the high volume of traffic experienced on the railroad lines),
- o ability to complete vapor monitoring points between and alongside the subsurface utilities with a minimal risk of contacting and damaging the utilities.

Soil vapor survey data, coupled with the ground water quality data yielded by the newly installed and existing wells will be analyzed, and the vertical and horizontal distribution of subsurface contamination will be determined.

4.7 Transport and Fate of Subsurface Contaminants

Data collected to date are insufficient to describe the transport and fate of the contaminants in the subsurface soil and ground water. Information collected during the implementation of this work plan will be utilized in empirical, analytical, and/or numerical models to predict the fate and transport of the contaminants.

4.8 Distribution, Transport, and Fate of Surface Contamination

Data collected to date are insufficient to characterize the distribution, transport, and fate of surface contaminants historically detected adjacent to the Strebor facility. Information collected during the implementation of this work plan will be used to determine if surface contamination still exists immediately east of the facility, and, if present, its primary transport mechanism.

5.0 REMEDIAL INVESTIGATION TASKS

5.1 Historical/Background Investigation

A background data review and interviews of former plant employees will be performed to obtain a more thorough understanding of the following:

- o historical site operations,

- o if possible, operations of adjacent manufacturing facilities (the former Allied Paper Corporation property, and the Redker-Young Holdings, Ltd. property) and their potential as a contributing source of subsurface contamination, and
- o ground water resources of the immediate area.

Data sources are anticipated to include: Michigan Department of Natural Resources (MDNR), U.S. Geological Survey (USGS), Michigan Geological Survey, U.S. Environmental Protection Agency (US EPA), and local planning and zoning agencies. The reliability of data and accuracy of background information will be ascertained during the review process.

5.2 Geophysical Investigation

The initial field investigation proposed for the Strebor facility is a detailed geophysical investigation. The purpose of the geophysical investigation is to further define the subsurface stratigraphy beneath and adjacent to the facility.

The geophysical survey will consist of a network of seven geophysical logging stations within and adjacent to the site completed to a depth of approximately 80 feet bg (Figure 15). Details regarding the installation of the logging stations are contained in Appendix and the "Methodology" Section of the Quality Assurance Project Plan (QAPP). After installation, the stations will be continuously logged with gamma ray and EM (induction) conductivity downhole tools. The gamma logs will provide continuous detailed stratigraphic data along the length of the logging stations. The log will delineate sequences of clay, silt and sand and has the capability of locating clay/silt lenses as thin as 3 to 4 inches thick.

EM induction logs will provide continuous conductivity information along the length of the logging stations. This data will reflect changes in sand and clay content as well as the presence or absence of ions in the surrounding soil and ground water. Details regarding the geophysical methodology and data interpretation are contained in Appendix and the QAPP.

The results of the geophysical investigation, supported by previously collected stratigraphic data will be utilized in the final design of the ground water monitoring network.

5.3 Subsurface Soil Sampling and Analyses

The subsurface soil sampling and analyses phase of this investigation will involve completing three soil borings within the suspected boundaries of the former lagoon and collecting soil samples for physical classification and chemical analyses. Proposed soil boring locations are shown on Figure 16.

Borings will be completed to a depth of approximately 20 feet by utilizing hollow stem auger drilling techniques in accordance with procedures outlined in the Appendix and the QAPP. Soil sampling will be completed on a continuous basis with a split-spoon sampler in accordance with Standard Penetration Test Procedures. Samples retrieved during the completion of the borings will be logged by a qualified geologist in the field. In addition to maintaining the logs of the borings, the field geologist will note any unusual subsurface features and contaminant conditions.

Soil/lagoon fill material samples collected at 5 foot intervals will be screened in the field using Jar Headspace Analytical Techniques. Headspace analyses will be performed with a portable organic vapor analyzer equipped with a photoionization detector (PID) according to procedures outlined in the Appendix and the QAPP.

Lagoon fill material and soil/lagoon fill material mixtures encountered during the completion of the borings will be collected for chemical analyses. A summary of the analytical parameters and methodology are contained in Table 1. Soil samples obtained for chemical analyses will be collected and placed into the appropriate glassware according to procedures outlined in the Appendix and the QAPP. All chemical analyses will be performed following US EPA or equivalent methodologies.

The soil boring logs, jar headspace analytical results, and soil/fill material laboratory analytical results will be evaluated to characterize the boundaries and materials formerly placed within the lagoon. The evaluation will be conducted to determine the concentrations of contaminants and their mobility and persistence (i.e., stability potential considering bio-degradation, adsorption potential, etc.) in the subsurface environment. The evaluation will also be used to identify potential treatment/isolation processes that may be included in any remedial action programs and long term monitoring plans.

5.4 Surface Soil Sampling and Analyses

The surface soil investigation will involve collecting three surface soil grab samples in a drainage area immediately east of the facility for chemical analyses. The purpose of the surface soil sampling/analyses is to determine if contaminants are present in the surface soils within areas historically impacted by surface spills and releases, and if contaminated surface sediments (if present) are being transported away from the site via surface water runoff.

Surface soil samples (0 to 0.5 feet bg) will be collected from the locations depicted in Figure 17. Sampling will be conducted in accordance with procedures outlined in the Appendix and the QAPP. Surface soil samples will be analyzed for parameters listed in Table 2 following US EPA or equivalent methodologies.

5.5 Soil Vapor Investigation

The soil vapor investigation will involve completing a soil vapor survey in a sequential fashion, starting within and adjacent to the sewer and railway lines located immediately east of the site, and laterally expanding the survey as field data dictate. The primary goal of the soil vapor survey is to determine if LWI product and/or dissolved contamination is preferentially migrating along sewer and railway backfill material.

A grid of approximately 19 soil vapor monitoring points will be completed immediately east of the Strebor property (Figure 18). The soil vapor monitoring points will be completed within the fill material beneath the railroad tracks and surrounding the sanitary sewer. As dictated by the vapor survey, additional soil vapor monitoring points may be completed east of the sewer and railway lines towards Portage Creek. The soil vapor survey will be completed according to procedures outlined in the Appendix and the QAPP.

Upon completion of the survey, the data will be utilized to:

- 1) examine the distribution of LWI product-based organic vapors in the soil beneath and adjacent to the railroad tracks and sewer line; and
- 2) determine if LWI product or dissolved constituents are preferentially migrating within the fill material.

5.6 Ground Water Investigation

The ground water investigation at the facility will entail an examination of the hydraulic flow regime in the water bearing formations underlying the site. The primary data collection mechanism for the ground water investigation involves the completion of ground water monitor wells.

5.6.1 Well Location and Installation

Data collected to date suggests that the installation of four ground water monitor wells within the unconfined aquifer will be sufficient to further characterize the ground water flow and contaminant migration characteristics. An additional four wells completed within the semi-confined/confined aquifer(s) are also proposed for this investigation. The proposed well locations are contained in Figure 19. The final number, location, and completion depth of the monitor wells/piezometers will be determined upon review of the geophysical survey results.

As indicated in Figure 19, all monitor wells completed within the semi-confined/confined aquifer will be paired with a monitor well completed in the unconfined aquifer. Well pairs will be utilized to provide vertical hydraulic gradient and vertical ground water contamination data.

All monitor wells and piezometers will be drilled, constructed, installed, developed, and sampled as outlined in the Appendix and the QAPP.

5.6.2 Aquifer Monitoring/Testing

Upon completion of the well installation program, an initial investigation will be conducted to determine the water levels in all existing and newly installed monitor wells. Water levels will be collected in accordance with procedures outlined in the Appendix and the QAPP. From these data, a water table contour map will be prepared depicting the hydraulic gradients across the site and the estimated direction of ground water flow in the aquifers of interest. Water levels in the underlying aquifer(s) will depict either an upward or downward hydraulic gradient, depending upon the composition of the stratum separating the aquifers.

Potentiometric contour maps will be provided for both the unconfined and semi-confined/confined aquifers, if appropriate.

To determine the hydraulic conductivity of the aquifers of interest, baildown recovery tests or slug tests will be completed. Methodology for completing the baildown recovery test and the data analysis techniques are contained in the Appendix and the QAPP. Data collected from the baildown recovery tests will be compiled and compared to previously collected hydraulic conductivity data to assess the areal hydraulic conductivity of the aquifers.

5.6.3 Ground Water Sampling and Analyses

Two ground water sampling/analyses rounds will be completed on all newly installed wells and selected existing wells. The second, confirmatory sampling round will be conducted one month following the first sampling event. A summary of the existing monitor wells to be sampled, and the analytical parameters and methodology for the existing and proposed wells are contained in Table 3. All ground water samples will be collected in accordance with procedures outlined in the Appendix and the QAPP. All chemical analyses will be performed following US EPA or equivalent methodologies.

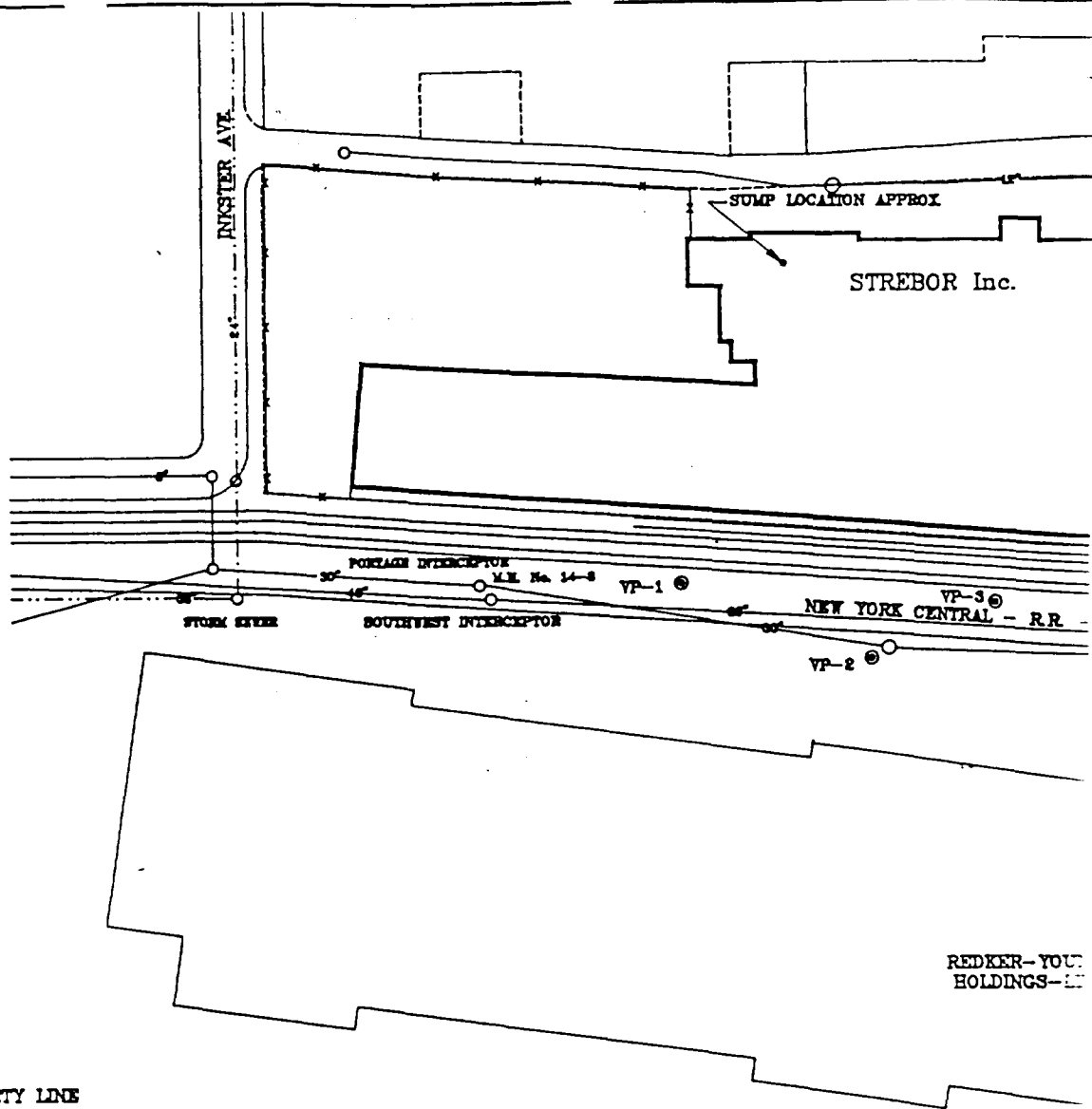
The analytical results will be evaluated to characterize the nature of the contaminants within and adjacent to the facility. This characterization will be conducted to determine the concentrations of the constituents, and their mobility and persistence in the subsurface environment. The characterization will also be used to identify potential treatment processes that may be included in any remedial action programs, and long term monitoring plans. The samples collected from the underlying aquifer will be analyzed to determine if, and to what degree, contaminants have migrated to the semi-confined/confined aquifer.

5.6.4 Ground Water Modeling

Ground water modeling will be performed to develop a mathematical simulation of the shallow ground water flow and contaminant transport systems in the vicinity of the Strebor facility. The USGS three-dimensional modular ground water flow model, MODFLOW, will be used to develop the flow model. Data from this model will be incorporated into the USGS

TABLE 3
Ground Water Sampling/Chemical Analyses Summary Table


Sample Location	Glassware Requirement	Chemical Analyses (Method)
All newly installed wells (both rounds)	(1)	phenols (EPA 604) VOCs (EPA 601 and 602) phthalates (EPA 606) THC as fuel oil (EPA 602)
MW-1, MW-22, MW-23, MW-8, MW-24, MW-25, MW-7, MW-9, MW-6, MW-27, MW-35, MW-4, MW-17, MW-26, MW-28, MW-29, MW-30, MW-31, MW-32, MW-33, MW-34 (both rounds)	(1)	phenols (EPA 604) VOCs (EPA 601 and 602) phthalates (EPA 606) THC as fuel oil (EPA 602)
MW-26, MW-29, MW-30, PSMW-2, PSMW-3, PSMW-4, PDMW-2, PDMW-3, PDMW-4 (first round only)	(2)	Homologous groups of CDDs and CDFs (EPA Method 8290 - High Resolution GC/MS) with the option to quantify 2,3,7,8-congeners within each group
MW-5, MW-21, MW-20, MW-11, MW-3 (first round) (water phase only)	(1)	VOCs (EPA 8240) Acid-B/N compounds (EPA 8270) Phenols (EPA 604) Phthalates (EPA 606) THC as fuel oil (EPA 602)
(1) - four 1-Liter Ambers Jars - four 40-ml VOA		
(2) - three 1-Liter Amber Jars		



LEGEND

- X- FENCE
- STREBOR PROPERTY LINE
- STORM SEWER
- SANITARY SEWER
- VP- PROPOSED SOIL VAPOR MONITORING POINT



ENGR'G	M.W.	DATE		BAY WEST Inc. ENVIRONMENTAL SERVICES ST. PAUL, MN.
DRAWN	K.M.	5/25/90		
REV.				
PROJECT NAME				STREBOR, INC.
TITLE SITE MAP/ PROPOSED SOIL VAPOR MONITORING POINTS				
DWG. NO.		7096-SA	SCALE	1"=120'
			FIGURE #	18

PORTAGE CREEK

STREBOR INC.
KALAMAZOO, MICHIGAN

SUPERIOR AVENUE

ALCOY STREET

OUTFALL 00A

PORTAGE INTERCEPTOR

SOUTHWEST INTERCEPTOR

DAM

OUTFALL 00A

PORTAGE CREEK

ALLIED CORP. PROPERTY

POLE BARN

WATER TOWER

VP-17

VP-18

VP-19

VP-14

VP-15

VP-16

VP-11

VP-8

VP-9

VP-10

VP-13

VP-12

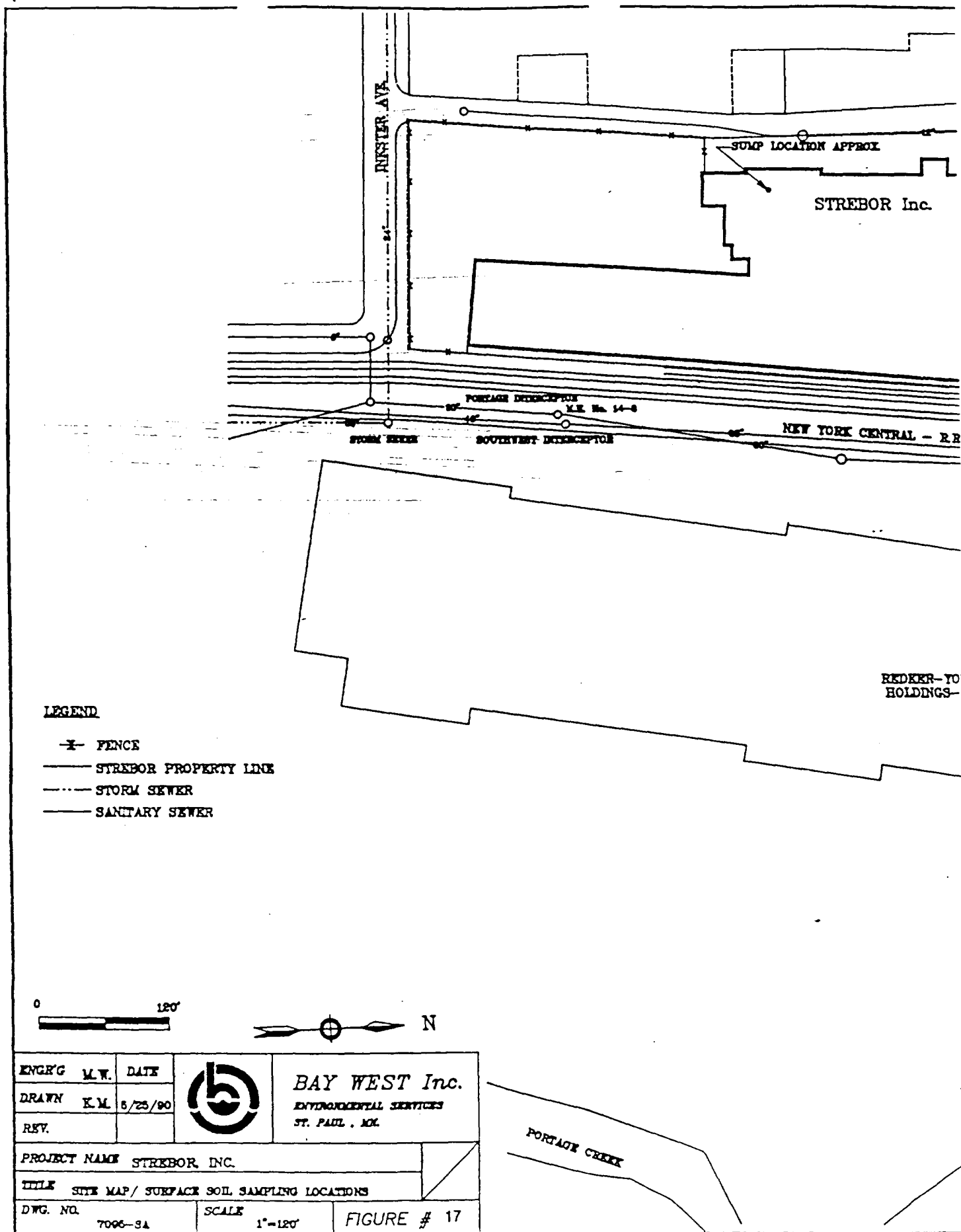
VP-6

VP-7

M.E. No. 14-1

M.E. No. 14-2

M.E. No. 1



STREBOR INC.
KALAMAZOO, MICHIGAN

SUPERIOR AVENUE

SURFACE SOIL
SAMPLE LOCATIONS

M.E. No. 14-1

M.E. No. 14-2

ALLIED CORP. PROPERTY

POLY BARN

WATER TANK

ALCOHOL STREET

OUTFALL SOA

PORTAGE INTERCEPTOR

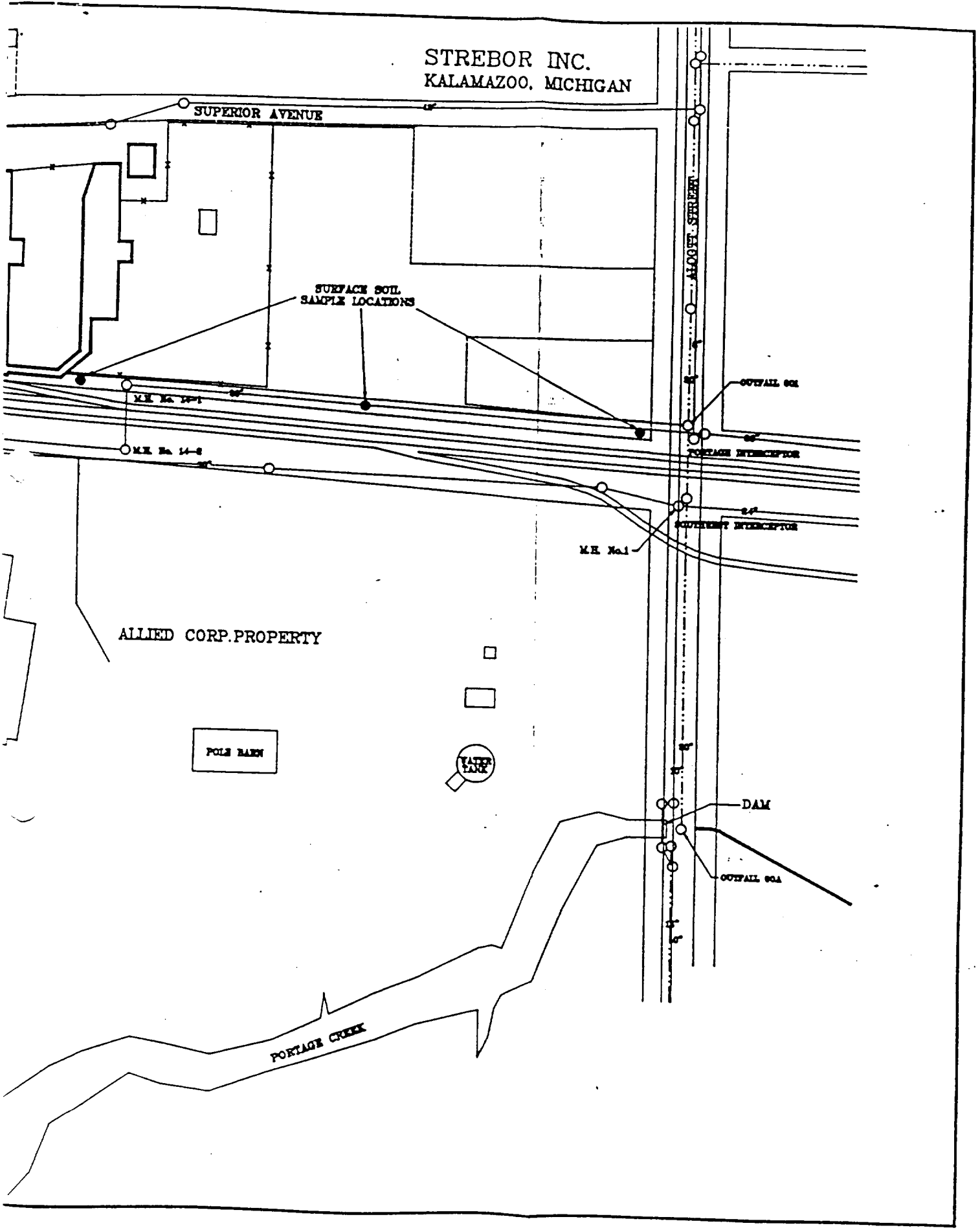
SEWERAGE INTERCEPTOR

M.E. No. 1

DAM

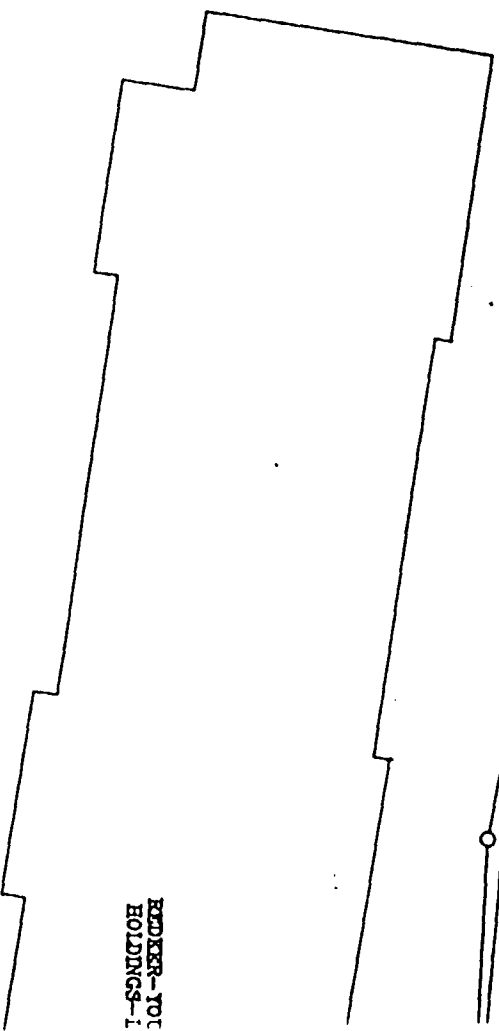
OUTFALL SOA

PORTAGE CREEK




LEGEND

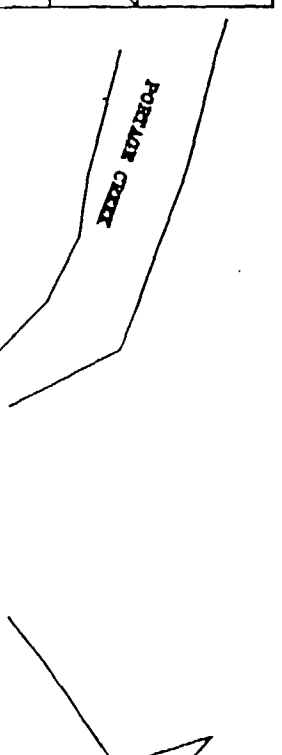
- X- FENCE
- STREBOR PROPERTY LINE
- - - - STORM SEWER
- SANITARY SEWER

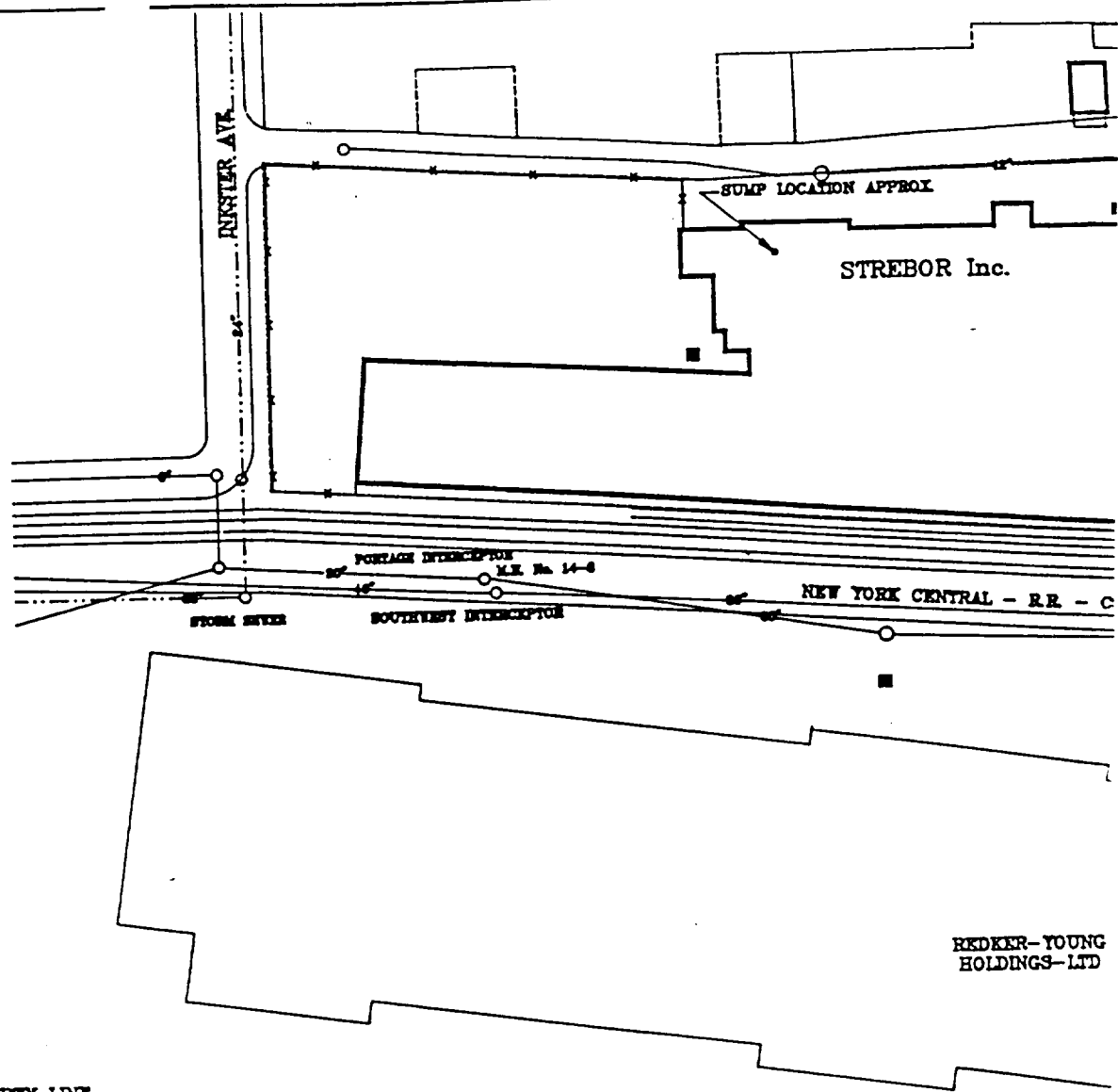


0 150'



ENGINEER	L. T.	DATE		BAY WEST Inc. ENVIRONMENTAL SERVICES FT. PULK. , MD.
DRAWN	E. L.	6/25/90		
REV.				
PROJECT NAME			STREBOR, INC.	
TITLE			SITE MAP / PROPOSED SOIL BORING LOCATIONS	
DWG. NO.	7086-84	SCALE	1"=150'	FIGURE # 16






LEGEND

- X- FENCE
- STREBOR PROPERTY LINE
- STORM SEWER
- SANITARY SEWER
- PROPOSED GEOPHYSICAL LOGGING STATION LOCATION



ENGR'G	M.W.	DATE	 <p>BAY WEST Inc. ENVIRONMENTAL SERVICES ST. PAUL, MN.</p>
DRAWN	K.M.	5/25/90	
REV.			
PROJECT NAME			
STREBOR, INC.			
TITLE SITE MAP/ PROPOSED GEOPHYSICAL LOGGING STATIONS			
DWG. NO.		SCALE	FIGURE #
7000-SA		1"=120'	15

PORTAGE CREEK

STREBOR INC.
KALAMAZOO, MICHIGAN

SUPERIOR AVENUE

ALCOFF STREET

OUTFALL 001

PORTAGE INTERCEPTOR

SOUTHWEST INTERCEPTOR

M.E. No. 1

ALLIED CORP. PROPERTY

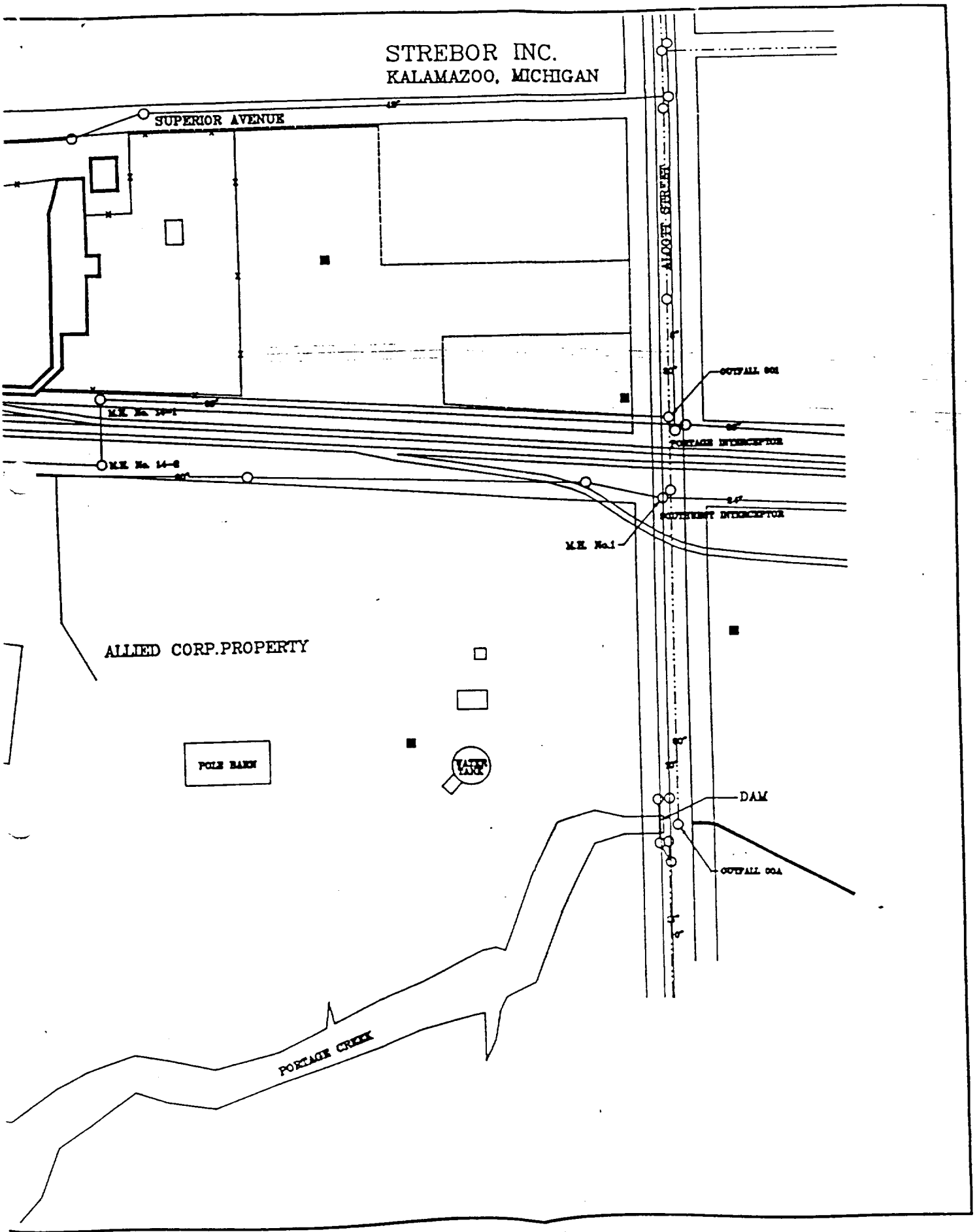
POLE BARN

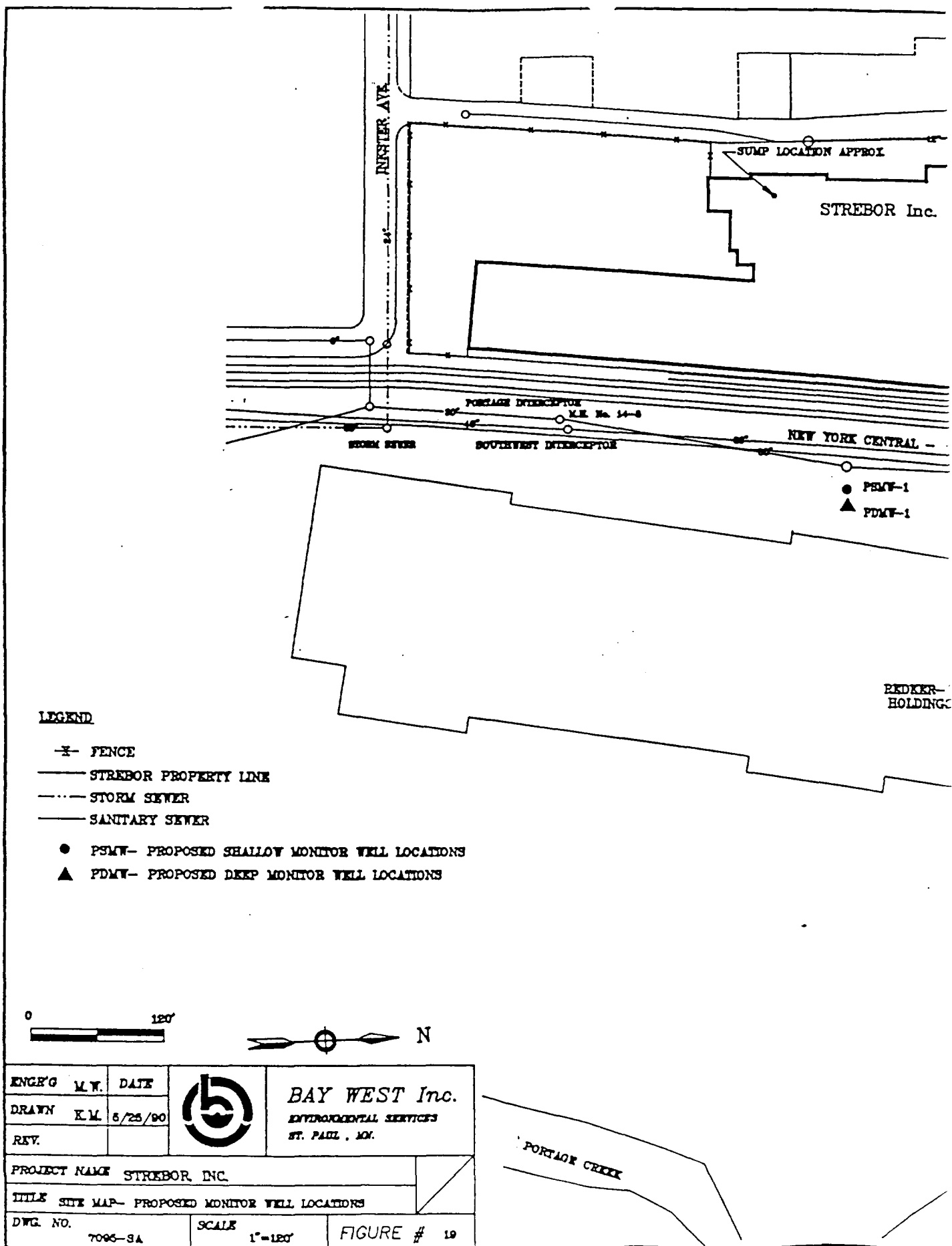
WATER TANK

DAM

OUTFALL 00A

PORTAGE CREEK





STREBOR INC.
KALAMAZOO, MICHIGAN

SUPERIOR AVENUE

ALCOFF STREET

PSMW-4
PDMV-4

OUTFALL BOX

PORTAGE INTERCEPTOR

SOUTHWEST INTERCEPTOR

M.H. No. 1

ALLIED CORP. PROPERTY

POLE BARN

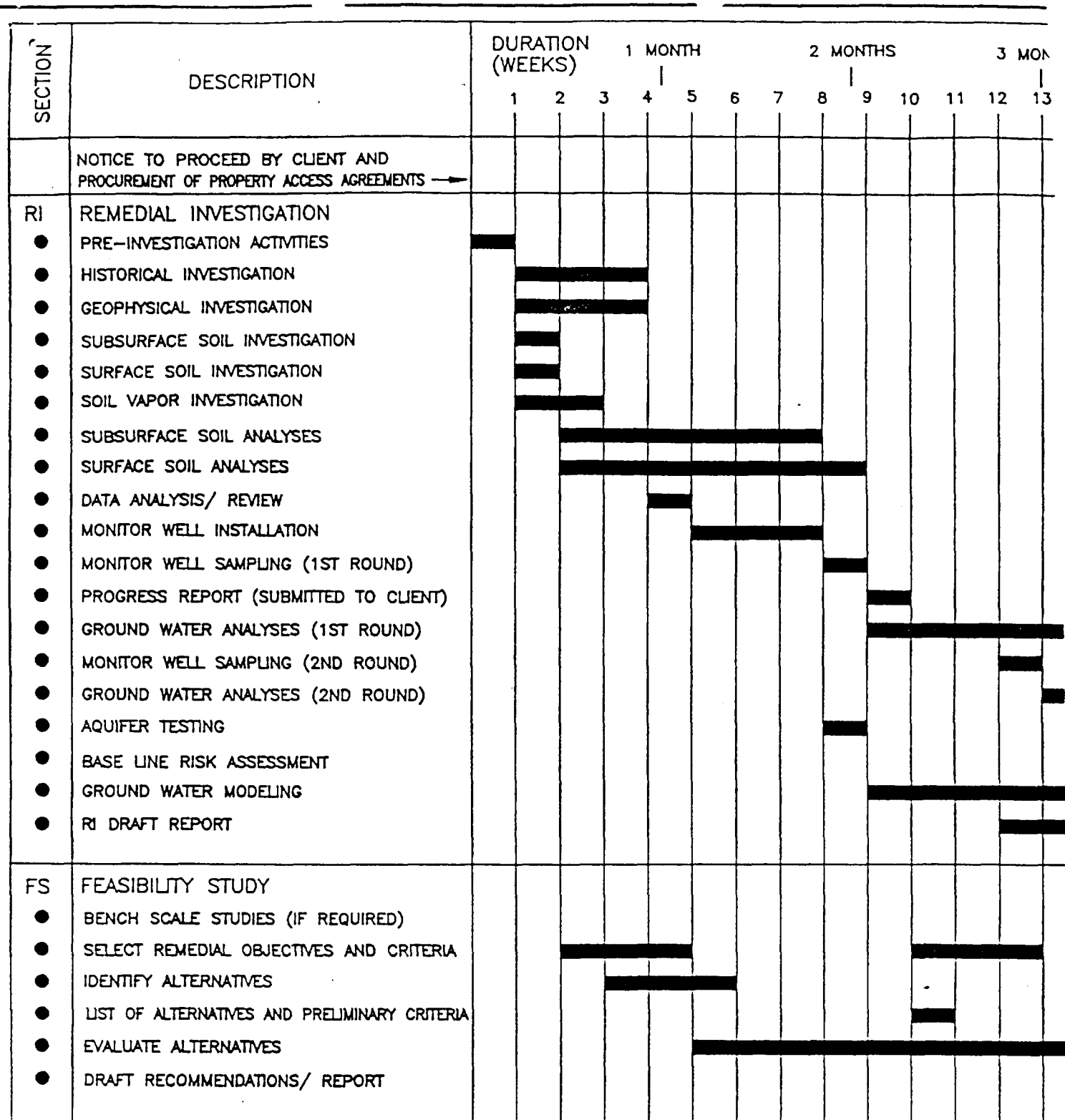
PDMV-2

PDMV-3
PSMW-3

DAM

OUTFALL BOX

PORTAGE CREEK



LEGEND:



ESTIMATED TIME LINE

